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Investigation on the Adult Population Fluctuations of *Coroebus rubi* L. (Coleoptera: Buprestidae) on Raspberry in Bursa Province in Turkey*

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Abstract: This study was carried out in Bursa in 1996, 1997 and 1999. The adult population fluctuations of *Coroebus rubi* L. were investigated by the using visual control method via counts made once or twice a week during a one hour period in an area of 0.1 hectare and the number of adults was evaluated weekly. As a result, the first adults of *C. rubi* were determined in late May or early June in 1996, 1997, and 1999, depending on the area where the raspberry plantations were located; and on the time where the flowers of the raspberry plants dropped and the fruits formed on the superior racemes. The adult population reached a peak between mid-June and mid-July varying according to the years and the time when the raspberry plants were at harvesting stage. The number of adults during the peak period changed between 3 and 82 adults/0.1 hectare per week, depending on the site of the orchard and the year. The duration of the adult flight period changed between 35 and 70 days ending in late July or early August, depending on site and year. The total number of adults counted in raspberry orchards during the flight period was minimum of 10 adults and maximum of 227 adults/0.1 hectare. Only one flight period of *C. rubi* was observed in all research areas, Therefore, it was concluded that the insect gave one generation in a year.

Key Words: *Coroebus rubi,* population fluctuations, raspberry, Bursa

Bursa İlinde *Coroebus rubi* L. (Coleoptera:Buprestidae)' nin Ergin Populasyon Değişimi Üzerinde Araştırmalar

Öz: Bu çalışma 1996-1999 yıllarında Bursa'da yapılmıştır. *Coroebus rubi* L.'nin ergin populasyon değişimi gözle kontrol yöntemiyle bir dekarlık alanda haftada 1-2 kez ve 1 saat süreyle yapılan sayımlarla incelenmiş ve ergin sayısı haftalık olarak değerlendirilmiştir. Sonuç olarak, *C. rubi*'nin ilk erginleri 1996, 1997 ve 1999 yıllarında ahududu bahçelerinin bulunduğu yere göre mayıs sonu haziran başında ve ahududu bitkisinde çiçekler dökülüp üst salkımlarda meyve teşekkül ettiği zaman saptanmıştır. Ergin populasyonu yıllara göre haziran ayının ikinci yarısı ile temmuz ayının ilk yarısı arasında ve ahududu hasat evresinde iken tepe noktası oluşturmuştur. Erginlerin tepe noktası oluşturduğu tarihlerde ergin sayıları bahçenin bulunduğu yere ve yıla göre haftada 3-82 ergin/dekar arasında değişmiştir. Ergin uçuşu, yine ahududu bahçesinin bulunduğu yere ve yıla göre temmuz sonu veya ağustos başında sona ermiş ve ergin uçuş süresi 35-70 gün arasında değişmiştir. Bu uçuş periyodu boyunca ahududu bahçelerinde sayılan toplam ergin sayısı en az 10 ergin/dekar, en yüksek ise 227 ergin/dekar olmuştur. *C.rubi*'nin araştırma yapılan yer ve yıllarda 1'er uçuşu izlenmiş ve dolayısıyla zararlı yılda 1 döl vermiştir.

Anahtar Kelimeler: *Coroebus rubi*, ergin populasyon değişimi, ahududu, Bursa

Introduction

Cane boring beetle, *Coroebus rubi* L. (Coleoptera: Buprestidae) is one of the major pests of raspberry orchards in Bursa (Kaya 1999). Thery (1942) reported that *C. rubi* existed in the Balkans, Anatolia, and Caucasia, as well as in Europe while Coutin (1994) reported that the same insect existed in European countries with coastal regions next to the Mediterranean sea.

The hosts of *C. rubi* in Bursa are the small fruits such as blackberry, rose hip, rose, and strawberry with the most invaded one being raspberry. The type of host plant subjected to injuries of economical importance varies depending on the site where the pest exists. Molinas (1922) and Genieys (1927) noted that *C. rubi* was harmful to rose in Southern France. Paoli (1928) reported that the pest was harmful to the rose in Italy as well. Tillyard (1927) pointed out that it was harmful to blackberry in the USA. Northcroft (1928) stated that it harmed raspberry and blackberry in New Zealand and Tillyard (1930) reported that it harmed blackberry in New Zealand at an economically significant level.

The raspberry is a novel fruit species in Turkey and its economically cultivated orchards are only available in Bursa province. The raspberry cultivation, which commenced in Bursa in 1986, is a good source of income especially for the forest villagers located at the northern foot of Uludağ (Bursa). However, raspberry cultivation has gained great importance in recent years due to the fact that it is suitable for intercropping, untilizes the secret labour, and provides income within a short time. On the other hand, the value of the raspberry for human health,

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its various means of consumption, and its suitability for cold storage increase its importance.

The pests of the raspberry were investigated in response to intensive demands of raspberry growers in Bursa and *C. rubi* was determined to be the major pest of raspberry (Kaya 1999). Both the adults and the larvae of *C.rubi* are harmful. The adults harm the plant by feeding on raspberry leaves and the larvae cause damage on raspberry canes. Nevertheless, the major damage is caused by the larvae. It is difficult to expect success from insecticide applications to the larvae located in the canes. Therefore, the target should be the adult stage. The adult emergence times, adult flight period, and change in adult population gain importance as a result of this fact.

The objectives of the study were to determine the first adult emergence time and to investigate the changes in the pest population in order to obtain the fundamental information for the control techniques to be applied to the adults and to determine the correlation between the plant phenology and the dates of first adult emergence and peak point of adult emergence. In this way, it will be possible to be successful in the control techniques to be applied in the light of the results.

Material and Methods

Study site : This study was carried out in Bursa ($40^0$18´N, 29^0 13´E) between 1996 and 1999. The adult population fluctuations of *C. rubi* were investigated in 1996, 1997, and 1999 in Fidyekızık (height: 320-460 m), in 1997 and 1999 in Aksu (height: 600 m), and in 1999 in Gözede (height: 700 m) as well as in unsprayed raspberry plants in the orchard. The investigations in Fidyekızık in 1999 were carried out in two different orchards located in the west (height: 320 m) and the north (height: 460 m) of Fidyekızık. Aksu, Fidyekızık and Gözede are on the northern outskirts of Uludağ (Olympus) where is in northwestern Turkey.

Adult population fluctuations : By means of counting the adults in a raspberry plantation of 0.1 hectare the adult population fluctuations of *C.rubi* were determined by using a visual control method (Baggilioni 1965). Through the raspberry cane countings was performed cautiously in order not to disturb the adults. Therefore, the opportunity for the adults to fly or pretend was reduced. The apparent adults on the plant were recorded without plants being touched at all. The countings were done especially at noon, owing to adult activity encountered at this time. The counts were made once or twice a week during one hour period in the areas of 0.1 hectare between May and August and were estimated weekly.

Results and Discussion

At the end of the studies, the adult population fluctuations of *C. rubi* in Fidyekızık in the years 1996, 1997, and 1999 were given in Figures 1, 2 and 3 respectively, while the adult population fluctuations in Aksu in 1997 were given in Figure 4, and the adult population fluctuations in Aksu and Gözede in 1999 in figure 5.

The emergence of the first adults in Bursa under natural conditions was determined to be on 30th May 1996, 12th June 1997, 27th May 1999 (in the western orchard) and 3rd June 1999 (in the northern orchard) in Fidyekızık; on 26th June 1997 and 27th May 1999 in Aksu; on 3rd June 1999 in Gözede (Figures 1, 2, 3, 4, and 5). The flowers of the raspberry plant dropped and fruits formed on the superior racemes and even they began to ripen on the dates of the first adult emergence. Genieys (1927), Balachowsky and Mesnil (1936), Della Beffa (1961), Balachowsky (1963), Coutin (1994) reported that the adults emerged in the first or second half of May in France and Italy. Our findings were in accordance with these references. The differences observed in the first emergence of adults might be due to the variability in the climatic conditions in the areas and years of investigation. On the other hand, determination of first adults in Aksu on 26th July in 1997 might be due to low adult population level.

The number of adults counted in raspberry orchards increased after the first adults of *C. rubi* were determined in the research area, and reached a peak on 27th June 1996, 10th July 1997, 24th June (in the western orchard) and 1st July (in the northern orchard) 1999 in Fidyekızık while the peak times were on 17th July 1997 and 8th July 1999 in Aksu and on 1st July 1999 in Gözede. The adult population levels on these dates were 47, 82, and 34 (in the western orchard) and 13 (in the northern orchard) adults/0.1 hectare, in Fidyekızık, 4 and 10 adults/0.1 hectare, in Aksu, and 3 adults/0.1 hectare in Gözede, respectively. More than 50% of raspberries were harvested when the adult numbers were at a maximum. On the other hand, the length that vegetative canes grew in the same year was nearly 1 m.

The adult flight period of *C. rubi* ended on 25th July 1996, 7th August 1997, 29th July 1999 (in the northern orchards) and 05th August 1999 (in the western and the northern orchards) in Fidyekızık while it ended on 31th July 1997 and 22th July 1999 in Aksu, and on 8th July 1999 in Gözede. The harvest of the raspberry was completed after the adult flights ended. The adult flight period in Fidyekızık was 56 days in 1996 and 1997, 70 and 56 days in the western and the northern orchards in 1999; while the adult flight periods in Aksu were 35 and 56 days in 1997 and 1999, respectively; and it was 35 days in Gözede in 1999. The total number of adults counted in this period was 152, 227, and 145 (in the western orchard), 52 (in the northern orchard) adults/0.1 hectare in Fidyekızık, 10 and 28 adults/0.1 hectare, in Aksu; and 10 adults/0.1 hectare in Gözede (Figures 1-5).

Balachowsky and Mesnil (1936) reported that adults were first captured in the second half of May in Antibes while they were captured on 10th May on blackberries in Esterel where adult emergence continued until 15th June. Furthermore Balachowsky (1963) and Coutin (1994)

reported that the flight period of *C. rubi* adults in France initiated in May whilst Lodos and Tezcan (1995) found this period to be between June and July in Turkey. Depending on regions, variation in flight period occurred. The confliction between actual adult flight periods and reference data might be due to alterations in areas and years of observations. In fact, Lodos and Tezcan (1995) informed us that the adult flight period changed depending on regions and generally occured in May and June.

Only one flight period of *C. rubi* was determined in a year in the observations and researches made in Bursa in 1996, 1997 and 1999. Balachowsky and Mesnil (1936), Balachowsky (1963), Lodos and Tezcan (1995) reported that the pest gave one generation in a year. Our findings were in accordance with these references.

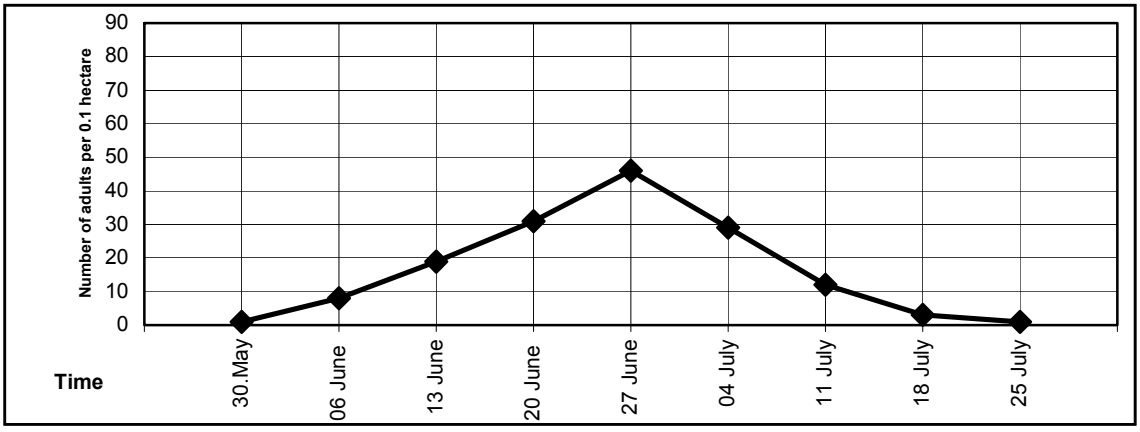

Figure 1. The adult flight period of *Coroebus rubi* at Fidyekızık in 1996

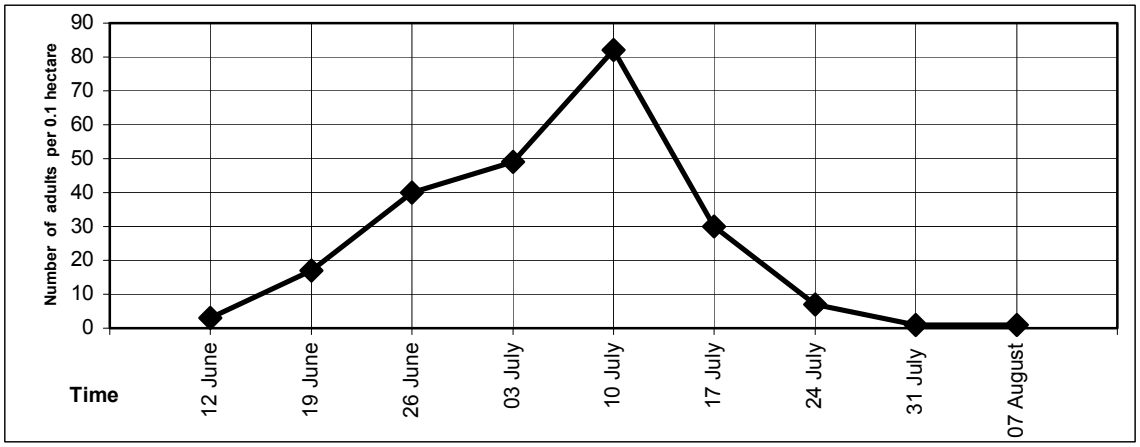

Figure 2. The adult flight period of *Coroebus rubi* at Fidyekızık in 1997

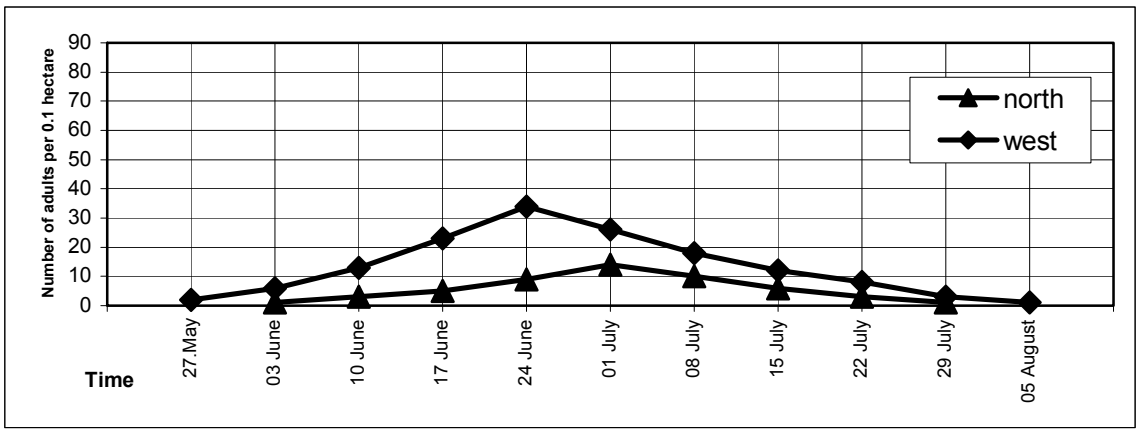

Figure 3. The adult flight period of *Coroebus rubi* at Fidyekızık in two different orchards in 1999.

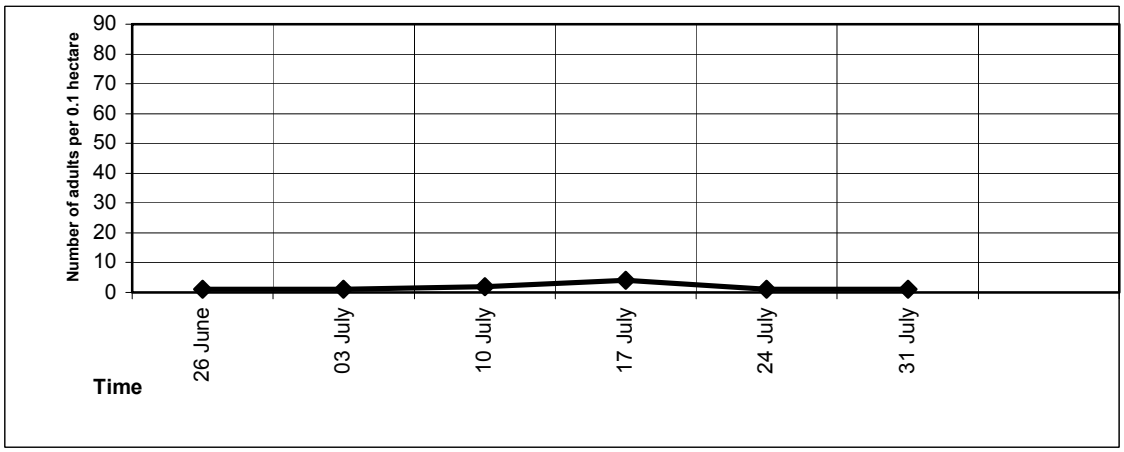

Figure 4. The adult flight period of *Coroebus rubi* at Aksu in 1997

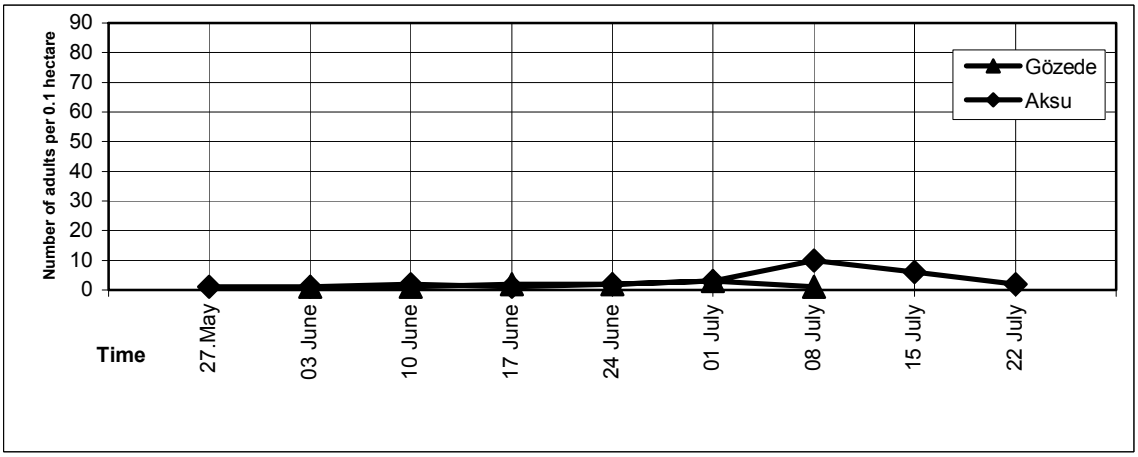

Figure 5. The adult flight period of *Coroebus rubi* in Aksu and Gözede in 1999

Conclusion

As a result, correlations were established between the first adult emergence of *C. rubi* and the peak time of the pest and the raspberry phenology was established. Moreover, it was concluded that the control of *C. rubi* should preferably be done against the adults and before the females lay their eggs in orchards where the pest is economically harmful.

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